FOREST PEST MANAGEMENT
Pacific Southwest Region

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EVALUATION OF PEST CONDITIONS IN THE KIVA/TAYLOR CREEK VISITOR CENTER RECREATION AREAS ON THE LAKE TAHOE BASIN MANAGEMENT UNIT

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ABSTRACT

Pest conditions in the Kiva/Taylor Creek Visitor Center recreation areas were examined. The primary pest complex included the Jeffrey pine beetle, annosus root disease, and overstocking. Other potential pests found in the areas were the mountain pine beetle, pocket gophers, Elytroderma disease, dwarf mistletoe in lodgepole pine, Atropellis canker, stalactiform rust, and western gall rust. Both short- and long-term management alternatives are given, including direct suppression of the Jeffrey pine beetle and ways to prevent/minimize annosus root disease impacts. The importance of integrating pest management considerations into vegetation management plans/prescriptions is discussed.

INTRODUCTION

Subsequent to an evaluation of Camp Richardson, Fallen Leaf Campground and other nearby areas conducted in 1980 by the Forest Pest Management (FPM) Staff (ref. 3430, Report to Forest Supervisor, Lake Tahoe Basin Management Unit (LTBMU), October 29, 1980, enclosed), FPM was requested to evaluate several additional developed recreation sites, special use areas, and summer home tracts (ref. 3430 letter to Director, FPM, September 30, 1981). Five of these areas were evaluated by John Wenz and Gregg DeNitto between June 28 and July 2, 1982. The purpose was to identify important insect and disease related problems and to provide pest management alternatives for consideration and use by the LTBMU in the development and implementation of silvicultural prescriptions/vegetation management plans for each of the sites.

On July 2, Wenz and DeNitto summarized their findings to LTBMU representatives, including Bob McDowell (Resources), Jim Schellenger (Small Sales), Don Brighton (Special Uses), and Jon Hoefer (Planning). Following the summary, members of the group visited selected sites in the field and discussed various management alternatives. This report covers the evaluation of the Kiva/Taylor Creek Visitors Center areas. Where appropriate, parts of the 1980 Evaluation are referenced to reduce repetition.

OBSERVATION/DIAGNOSIS

The locations of specific pest-related problems are given on maps (forwarded under separate cover). Three annosus root disease (Fomes annosus) centers were found, two associated with Jeffrey pine and the other with white fir. Light to moderate Elytroderma disease (Elytroderma deformans) infections were present in Jeffrey pine throughout much of the area, especially near Highway 89. Infection levels were variable between trees; some small brooms were evident. Infection levels increased as Taylor Creek was approached. Atropellis canker (Atropellis piniphila), stalactiform rust (Peridermium stalactiforme), and some western gall rust cankers (Peridermium harknessii) were present on lodgepole pine. Dwarf mistletoe (Arceuthobium americanum) was also found infecting lodgepole pine in the northern end of the site near the lake. Pocket gopher (Thomomys monticola) activity (burrow construction) was noted in some open brushy areas between and adjacent to timbered areas. Two bark beetles were active in the area, the Jeffrey pine beetle (Dendroctonus jeffreyi) in Jeffrey pine and the mountain pine beetle (D. ponderosae) in lodgepole. A number of currently infested trees in groups of from 5-7 to 25-30 trees/group were identified. Most of the infested trees were situated in aggregations containing basal areas of 400 sq.ft./acre or greater (up to approx. 600 sq.ft./ac) and some were located adjacent to trails, roads and parking areas where construction activities had occurred within the last year. Most of the currently infested trees were just beginning to fade; some were still green. They contained late larvae, pupae and brood adults that had developed from attacks in the summer and fall of 1981. Most of these currently infested trees occurred in close proximity to groups of trees killed by the previous (1980) generation of the Jeffrey pine beetle (JPB). Additionally, a few green trees (located close to currently infested trees) had been recently attacked (parent adult beetles were in the early stages of egg gallery construction), indicating that emergence of, and attack by, the overwintering generation had begun.

BIOLOGY OF PEST ORGANISMS

The biologies of several of the pest organisms found in the Kiva/Taylor Creek area were discussed in the 1980 Evaluation (pp. 5-6). The others (annosus root disease, pocket gopher, atropellis canker and western gall rust) are given in Appendix A.

PROGNOSIS

The population dynamics of the JPB are not understood to the degree that the amount of mortality (due to JPB) in a given location for a given year can be predicted with much accuracy and reliability. Unknown and/or difficult to measure factors include: 1) the amount and significance of under-bark brood mortality due to parasites, predators and other causes, 2) the number of beetles that will emerge during the summer, 3) the "quality" or "vigor" of the emerging beetles, 4) how far and in what direction(s) the emerging beetles will fly, 5) how much in-flight mortality will occur, and 6) the "vigor" or susceptiblity of potential hosts. However, it is reasonable and, given the high recreational values involved, possibly judicious to assume, given "normal" weather conditions, that 1983 mortality will be similar to the 1982 level. This is based on the relatively high level of mortality over the past two years in the South Shore area and the presence of trees that continue to be stressed (predisposed) by competition due to overstocking, annosus root disease, and damage to the roots and lower bole from road, trail, parking lot, and drainage ditch construction. Over the long run, both the number of new infections and size of existing annosus root disease centers will increase. Trees near the edge of active centers will become infected through time and probably be attacked by the JPB.

The continuing JPB-related mortality will likely include some of the highly valuable, 250-plus year old "monarchs" and will result in increasing numbers (and size) of unplanned openings in the vegetation. Such openings may be conducive to windthrow and the creation of hazardous tree situations. The resulting changes in the pattern of vegetation may well have negative impacts on the vegetation management objectives developed for the site.

Some mountain pine beetle-related mortality will continue to occur, particularly in areas where lodgepole pine is subjected to a fluctuating water table. (A more complete discussion of the mountain pine beetle situation and management alternatives will be included in the evaluation report covering the Meeks Bay recreation sites). The canker and rust diseases will also continue to infect Jeffrey and lodgepole pines. Their effect, from a mortality standpoint, will be minimal. Large stalactiform rust cankers and deep hip cankers of western gall rust could structurally weaken individual lodgepole pines and make them hazardous, depending on their locations. The canker and rust diseases may also contribute to weakening infected trees and increasing their susceptibility to attack by JPB/MPB.

MANAGEMENT ALTERNATIVES

Both pest-specific treatments and integrated management alternatives were presented in the 1980 Evaluation (pp. 6-13) and are still germane. Following are some additional comments relevant to the current situation. They are organized by individual pest for clarity but should be integrated as appropriate into vegetation management plans.

Jeffrey pine beetle

a) Direct suppression. Observations made since 1980 have indicated that many of the Jeffrey pines killed tend to be located near trees killed in previous years, providing circumstantial evidence that emerging adults are flying relatively short distances before attacking new hosts. Based on these observations, one alternative is to destroy/remove JPB brood in currently infested trees with the objective of reducing the probability (by some unknown amount) that nearby trees will be killed by the beetles that emerge in the spring-summer of 1983. This would not constitute attempting to reduce Jeffrey pine beetle populations over the general area and would not preclude beetles flying in from outside the treatment area and causing mortality. However, given the very high values of the resources involved, it may be worthwhile to assume that mortality can be significantly reduced in 1983 by the destruction/removal of the brood in currently infested trees, as opposed to taking no action and thus having no chance to reduce mortality in 1983.

The following alternatives are available to destroy/remove JPB brood in currently infested trees. All involve identifying, marking, and felling currently infested trees. Time of implemention would depend on the treatment, but in all cases would be prior to emergence, which, depending on weather conditions, could begin by mid-May and, most likely, by mid-June. It should be emphasized that this direct suppression effort is an interim, short-term strategy; long-term, preventive alternatives are discussed in the 1980 Evaluation (pp. 9-10).

1. Removal of infested trees from the area. The objective is to remove currently infested trees from the area, within the time constraints noted above, so that if and when the adults emerge, they are not a threat to trees in the treatment area. It would be best to have the infested trees moved to an area distant from any Jeffrey pine stands to eliminate the chances of beetles emerging (if, for example, the trees are not milled, processed or utilized in other ways early enough) and attacking Jeffrey pine in the area. A firewood sale might be an option if it could be guaranteed that the wood would be stored/utilized in non-Jeffrey pine areas or burned prior to adult emergence.

2. Peeling the bark. Jeffrey pine beetle brood feed and develop between the bark and the wood. Peeling off the bark exposes the brood to desiccation and predation. If done in a timely manner, this technique should be completely effective in killing the brood. However, at this time of year the bark tends to be difficult to peel and implementation would be labor intensive.

3. Burning infested trees. Burning infested trees to the degree that the bark is almost entirely consumed (not just scorched) should also be effective. Problems involve transporting the trees to a suitable burn location, getting burn temperatures high enough to consume the bark (particularly when bark is thick), and disposal of post-burn residues.

4. Submergence in water. Storing infested logs in water (such as mill ponds) can probably be effective if submerged for 6 weeks or longer. The logs must be rolled to submerge the upper surface for an additional six week minimum.

5. Insecticides. Little work has been conducted relative to the effects of insecticides on JPB. Perhaps the best potential insecticide option available to the Forest Service is Dursban 4E. The efficacy data for this material is based on studies with the southern pine beetle. A Special Local Need (SLN) registration from the California Department of Food and Agriculture would be needed as well as an approved Pesticide Use Proposal (FS-2100-2). Another insecticide, Sevimol-4, might be an option, but is currently only registered for preventive, not remedial, treatment and would also require an SLN. It is also considered to be less efficacious than Dursban 4E for remedial treatment.

b) Individual tree protection. This approach is discussed at some length in the 1980 Evaluation (p. 9). Experimental work (relative to the western pine beetle, D. brevicomis) is continuing using the following chemicals, in addition to Sevimol-4 and Dursban 4E: Sevimol-4 at reduced rates, sevin XLR (an untested formulation), permethrin and fenitrothion. FPM will keep the LTBMU informed of results as they become available.

Annosus Root Disease

No direct methods are currently available for controlling or eliminating annosus root disease once it is established in a stand. Strategies available to reduce the impacts of Fomes annosus include taking action to: a) prevent the initiation of new centers by reducing the probability of stump infection and b) implement silvicultural treatments to infected stands or plant aggregations to minimize disease effects. Alternatives include the following:

1. Prevent stump infection. Application of granular borax to freshly cut stumps is effective in preventing most (90%) new infections. The chemical is toxic to the spores of F. annosus, but has no effect on existing infections. Borax application within a few hours of tree felling is required on all stumps cut in and near developed recreation sites (FSM R-5 Supp. 2305 and 2331.33). Application requires the prior submission of a Pesticide Use Proposal to FPM in the Regional Office. The authority to approve the use of borax will be delegated to the Forest Supervisors this spring.

2. Regulate species composition. This alternative involves revegetating the openings created by the root disease-related mortality with species resistant or not susceptible to Fomes annosus. Since F. annosus spreads readily from pines to other conifers and can infect all conifers found in California, the best option for regenerating active annosus centers in pine (should this be desirable or necessary) is with resistant hardwoods and/or shrubs. Native hardwood species available

for consideration on the LTBMU include quaking aspen (Populus tremuloides), alder (Alnus sp.), black cottonwood (Populus trichocarpa) and willow (Salix sp). These species are found primarily in riparian areas in the Basin but, considering the high water table in the eastern parts of the Estates-Kiva areas, it would be worthwhile to consider trying to establish hardwoods, particularly quaking aspen and black cottonwood. The use of native shrubs should not be overlooked as a possibility, since they could be compatible with recreation management objectives. Observations indicate that F. annosus centers in true fir can be successfully revegetated with pines.

Planting the openings with non-susceptible species does not reduce/prevent the enlargement of the centers. However, interplanting the edges of the centers with hardwoods could reduce the rate of spread by competing for root space with infected conifers. The hardwood root system would grow and spread relatively rapidly and reduce/prevent root contacts between infected and uninfected conifers. This will increase moisture and nutrient competition and might require reduction of the level of conifer growing stock in the area.

In regenerating the openings, consideration should be given to planting or transplanting relatively large trees (5-15 years) that have been started from seed collected near the area or are actually growing in the area. Regeneration plans should also consider the need to water/fertilize the seedlings/transplants and provide protection (screening/fencing) from recreationists and vertebrate pests, particularly during the establishment period. Such actions will greatly increase the chances of survival and reduce the need to repeat regeneration efforts.

3. Stump removal. Fomes annosus can survive for up to 50 years as a saprophyte in the roots of infected stumps and trees, but will die out when such substrates decompose or are otherwise not available. In the Kiva area, in part because of the high water table, infected stumps will probably deteriorate in about 20-30 years, reducing the amount of substrate available for the fungus (substrate would still be available at the active edge of the center). Thus, the amount of root disease inoculum should be reduced in 20-30 years, and, after this time period, conifers could be replanted with highly reduced chances of becoming infected.

Removal of infected stumps is intended to increase removal of the substrate and reduce the amount of inoculum in soil more quickly, thereby decreasing the period of time before conifers could be established in the mortality center. This technique has not been shown to be effective experimentally and has not been tried operationally in California. Problems include economic and physical constraints relative to the need to remove, or at least breakup, most of the root system. However, since in the Kiva situation, there are few root disease centers and relatively few stumps involved, it might be a feasible approach. To have the best chance of being successful, infected trees/root systems on the edges of the active mortality centers should be removed and non-susceptible hardwood species planted around the periphery to increase root comptetion

with the conifers. This would reduce, and perhaps eliminate, spread of the center. If the LTBMU decides to implement this alternative, it is strongly encouraged that FPM personnel be utilized in its application and in monitoring to determine efficacy of the treatment.

4. Utilization of Fomes induced openings. This can be considered from a couple of different viewpoints. It is possible to utilize the openings for parking lots, restrooms or other facilities and structures rather than removing living trees to provide space for them. It should be recognized that some mortality, potentially creating hazardous tree situations, may occur around the edges of such areas, as Fomes infects additional trees through root contact. Options for reducing this problem, discussed above, include planting hardwoods and stump removal. Also, root disease centers in true fir could result in the creation of living hazardous true firs that are root and butt rotted. Or it may be that the openings created by the root disease - bark beetle interactions are compatible with recreation management objectives, or at least not a serious problem, depending on their size and location. In this case, they could be left "unmanaged" for 20 to 30 years and then, if desired, replanted to conifers. This strategy would contribute to creating an uneven-aged stand structure. As noted previously, this approach could be integrated with measures designed to reduce or eliminate radial spread of the fungus.

Pocket Gophers

Gophers are not currently a problem in the areas evaluated, but should be considered as a potential problem if alternatives involving regeneration are implemented. If no action is taken, pocket gophers may seriously hinder or prevent successful establishment of vegetation in open areas. The most appropriate time to initiate control of pocket gophers is prior to planting/transplanting when populations are naturally low and chances of maintaining them at non-damaging levels are increased. Maintenance treatments should be conducted during the establishment period. Pocket gopher management alternatives include the following:

1. Trapping. Trapping is extremely time consuming and is practical only on small areas or as a supplement to other forms of control. It should also be effective for annual maintenance after initial control efforts.

2. Fumigation. The extent of the burrow system and the ability of gophers to plug off their burrows makes the use of gas unsatisfactory and relatively expensive.

3. Baiting. Use of a mechanical burrow builder in campgrounds or other recreation areas may not be practical. Hand baiting with strychnine-treated grain bait placed in gopher burrows is the most practical and effective method of direct control. Control is most effective when there is fresh mound-building activity and when soil moisture is adequate to prevent collapse of the burrows. These conditions usually occur during late fall and early spring. The ability to irrigate a campground would make control possible anytime fresh activity

occurs. This method could be safely used when campgrounds are open, but would probably be best used when the campgrounds are closed. Since the bait is placed underground and most gophers die in the burrow system, secondary-poisoning and nontarget hazards are minimal.

4. Physical Barriers. Individual seedling protectors like "Vexar" have provided short-term protection to coniferous seedlings. However, long-term efficacy and effects on trees are still under study. Physical barriers will not prevent damage to established trees and shrubs. This approach is most effective when integrated with other control methods.

5. Habitat manipulation. Control of vegetation (grasses, herbs, etc.) that favors build-up of pocket gopher populations is effective in reducing gopher populations, but is not always consistent with vegetation management objectives in heavily used recreation areas. As noted above, gopher control should be initiated prior to vegetative manipulation, such as thinning, that could encourage the establishment of gopher-favorable habitat, if artificial regeneration of nearby areas is being considered.

Vegetation Management

The pest-specific alternatives discussed above are compatible with, and in fact should be considered as an integral part of the vegetation management plans for the area. If implemented in conjunction with treatments designed to regulate stocking density, species composition (increase diversity), and size and age class, chances are good that pest-related mortality will be reduced and maintained at acceptable levels.

APPENDIX A

BIOLOGY OF PEST ORGANISMS

Annosus Root Disease (Fomes annosus): Fomes annosus is a fungus that attacks a wide range of woody plants, causing a decay of the roots and lower bole and death of sapwood and cambium. All conifer species in California are susceptible to the fungus. Hardwood species are rarely damaged or killed. In one instance, madrone (Arbutus menziesii) was attacked. Infected pines are usually killed rather rapidly when the fungus girdles the root collar. Older true firs and incense-cedars usually survive infection for many years, although butt and root rot may become extensive, resulting in tree weakening and windthrow.

During favorable periods, the fungus forms fruiting bodies in decayed stumps, under the bark of dead trees, or in the duff at the root collar. The fungus becomes established in freshly cut stumps from air-borne spores produced by the conks, and then grows into the root system. True fir can also be infected by spores invading fresh basal wounds. The fungus subsequently spreads to healthy roots of surrounding susceptible tree species via root contacts. In general, infections will cross from pine to true firs; however, rarely is the fungus observed to go from true fir to pine. Local spread of the fungus outward from a stump typically results in the formation of disease centers, with dead trees in the center and fading trees on the margin. These centers usually continue to enlarge until they reach barriers such as openings or groups of nonsusceptible plants.

The fungus may remain alive for as long as 50 years as a saprophyte in infected roots and stumps. Young susceptible tree species often become infected and die after their roots contact old infected root systems in the soil.

Western Gall Rust (Peridermium harknessii). Western gall rust causes branch galls and trunk cankers on nearly all species of hard pines. The rust fungus produces yellow to orange-colored spores (aeciospores) on the surface of the galls during cool, moist, spring weather. The spores are wind disseminated and can infect other pines directly. Invasion of the pine bark by the rust fungus results in the formation of woody galls. Galls on branches are typically subglobose or spindle-shaped. The galls continue to enlarge and produce new spores each spring until they have girdled and killed the branch or stem. Girdling of branches results in a reduction of tree growth. Trunk cankers deform and reduce the strength of the bole.

Atropellis Canker (Atropellis piniphila). Atropellis canker occurs as a perennial canker, principally of lodgepole pine in the Pacific Coast States. It causes an elongate, sunken depression on the bole, usually at a branch whorl. The canker may exude considerable resin and the wood behind it is stained bluish-black. The fungus produces small, disc-shaped fruiting bodies on the canker face which release spores during the host's growing season. New infections are thought to occur through

undamaged bark of the stem and living branches, mainly in the nodal region. As host tissue ages, susceptibility to infection changes with the greatest susceptibility during the sapling and pole stages. Cool, moist sites appear to favor the occurence of the disease.

Stalactiform Rust (Peridermium stalactiforme). This rust fungus attacks lodgepole, Jeffrey, and ponderosa pines. It causes limb rust of Jeffrey pine and main stem cankers of ponderosa and lodgepole pines. These pine hosts support production of orange aeciospores in the spring that are windborne to the alternate hosts, members of the figwort family. Two spore stages develop consecutively on the foliage of these alternate hosts. Basidiospores are formed on these hosts in the fall and are wind-disseminated short distances to infect pine needles. The fungus then grows down into the pine branch and is perennial.

Infected Jeffrey pines have symptoms of limb rust with individual branches in the lower crown having cankers and dying. These symptoms spread upward in the crown. The fungus causes an elongated, sunken canker on lodgepole pine that usually bleeds resin profusely.

Pocket Gopher (Thomomys monticola). Pocket gophers live in closed burrow systems and spend most of their time below ground. The crescent-shaped mounds and plugged burrow entrances are major signs of gopher presence and activity. These animals are solitary except during the breeding season and when young are being raised. Pocket gophers eat succulent underground parts of plants, although they may graze above ground on plants near burrow openings. Breeding occurs in early spring when green forage is plentiful, and litters of 4 to 8 young are born after a gestation period of 18 to 19 days. An annual turnover of more than 75 percent of the population is common. Young disperse, usually aboveground, in late summer. Mound-building activity is most common during the late summer or early fall when young are dispersing and establishing their own burrows and adults are enlarging their systems in preparation for winter. Pocket gophers are active year round and even burrow through snow. Where preferred forbs and grasses are lacking, pocket gophers may feed on the roots of large trees.

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United States Department of Agriculture Forest Service RO

Reply to: 3430 Evaluation

Date: January 14, 1983

Subject: Evaluation of Pest Conditions in the Kiva/Taylor Creek Visitor Center Recreation Areas on the LTBMU

To: Forest Supervisor, Lake Tahoe Basin Management Unit

The enclosed biological evaluation concerns pest-related problems in the Kiva/ Taylor Creek Visitor Center areas of the South Shore Recreation Complex on the Lake Tahoe Basin Management Unit (LTBMU). The most important pest complex identified included the Jeffrey pine beetle, annosus root disease and overstocking. This complex is also of primary concern throughout the adjacent Estates area. Both short - and long-term pest management alternatives are discussed. Maps giving the location of specific pest-related problems will be forwarded under separate cover the week of January 17.

Subsequent observations made during the week of September 20, 1982, supported the earlier prognosis that considerable Jeffrey pine beetle-related mortality could likely be expected in the summer and early fall of 1982. Additional observations made at this time by John Borrecco (Fisheries and Wildlife Management Staff), concerning vertebrate pest problems in the areas evaluated are included in this report.

If you have any questions about the evaluation, please contact John Wenz or Gregg DeNitto of my staff at (415) 556-6520.

Richard A. Smith

WILFRED L. FREEMAN, JR., Director
Forest Pest Management

Enclosure

CC: Separate Cover